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Application of a Co-planer Log Periodic Antenna to Airborne Vehicles For Enhanced VHF INTERcept Capability

Existing antenna types mounted on the airborne platform which are intended for use in the VHF (50mc - 400mc) region are of two types. The first type (rams horn) is actually nothing more than a transformer which matches the receiving system to the vehicle skin. Since the entire surface of the vehicle is excited a somewhat unpredictable multilobed pattern is produced which may vary significantly at different frequencies.

For this reason the antenna gain in the desired direction at a specified frequency can be as much as 20db below isotropic. In addition, the antenna exhibits resonant characteristics which produce a serious mismatch to the receiving system at various frequencies. For these reasons the antenna produced completely unpredictable results. For example, in actual airborne tests against a ground target emitter a VHF receiving system, which was alternately switched from port to starboard antennas, proved to be more effective when switched to the antenna which was mounted on the side of the vehicle looking away from the target. Under all conditions the system sensitivity was well below that predicted for dipole gain characteristics. The second antenna type, the undersized spiral, can be matched to a reasonable degree and does produce a directive pattern. However, the effective gain of the antenna is from 10db to 20db below isotropic.

A recently developed antenna type has performance characteristics which can provide a significant improvement in airborne system performance. The coplaner log periodic antenna is inherently a broad band device (a decade). It exhibits relatively high gains - (6-8db) over a dipole. It has good front to back ratios giving good pattern predictability. It also maintains a low $VSWR$ (less than 1.75 to 1) over its useable bandwidth.

The above characteristics make the log periodic an excellent choice for a broad band intercept system. The additional gain over a dipole may mean the difference between success and failure of the system when the signal to be intercepted is radiated at low peak power levels and intercepted at long ranges. Predictability of the pattern allows the antenna to be oriented to take advantage of the high gain lobe. The orientation is not critical, however, because the main lobe - 3db points span approximately 65°.

The stable gain and predictable directivity characteristics of this log periodic antenna relative to the rams horn or spiral would improve system performance considerably. The most significant improvement will be an increase in system sensitivity from 6db to 20db over the

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frequency band of 50mc to 400mc. In addition, the directive characteristic of the log periodic antenna will provide a significant reduction in interfering signal levels.

The need for good airborne broad band VHF-UHF antenna has long been recognized. The antenna has not been developed for various reasons. The two major problems associated with a log periodic airborne antenna are difficulty in mounting on high performance aircraft and the expense involved.

The installation on jet aircraft requires the antenna to have an airfoil design for minimum degradation of vehicle performance. The antenna must have great structural strength to withstand the wind loadings. The testing program for such a design may become quite expensive.

It is recognized that some degradation in aerodynamic performance will occur. However, a very significant improvement in system performance can be obtained.